Chapter 11
A Framework for Responsible Innovation in the Business Context: Lessons from Responsible-, Social- and Sustainable Innovation

Rob Lubberink, Vincent Blok, Johan van Ophem, and Onno Omta

Abstract While the concept of Responsible Innovation is increasingly common among researchers and policy makers, it is still unknown what it means in a business context. This study aims to identify which aspects of Responsible Innovation are conceptually similar and dissimilar from social- and sustainable innovation. Our conceptual analysis is based on literature reviews of responsible-, social-, and sustainable innovation. The insights obtained are used for conceptualising Responsible Innovation in a business context. The main conclusion is that Responsible Innovation differs from social- and sustainable innovation as it: (1) also considers possible detrimental implications of innovation, (2) includes a mechanism for responding to uncertainties associated with innovation and (3) achieves a democratic governance of the innovation. However, achieving the latter will not be realistic in a business context. The results of this study are relevant for researchers, managers and policy makers who are interested in responsible innovation in the business context.

R. Lubberink (✉) • O. Omta
Department of Management Studies, Wageningen University, Wageningen, The Netherlands
e-mail: rob.lubberink@wur.nl

V. Blok
Management Studies Group, School of Social Sciences, Wageningen University,
Hollandseweg 1, 6707 KN Wageningen, The Netherlands

Philosophy Group, School of Social Sciences, Wageningen University,
Hollandseweg 1, 6707 KN Wageningen, The Netherlands

J. van Ophem
Department of Economics of Consumers and Households, Wageningen University,
Wageningen, The Netherlands

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11.1 Introduction

The European Commission wants to accelerate innovation and technological development to address the 'Grand Challenges' of our time, such as global warming, ageing populations and resource scarcities. They state that "*Europe's future is connected to its power to innovate. The Innovation Union, an action-packed initiative for an innovation-friendly Europe, is the solution*" (European Commission 2013, p. 2).

Although technology and innovation have a positive connotation, one can question whether they are inherently good (Von Schomberg 2013). Innovations can have short-term advantages but also come with uncertainties, questions and dilemmas regarding the future impacts and consequences (Stilgoe et al. 2013). The combustion engine for instance is nowadays essential for transportation but also one of the main causes of CO2 emissions. Likewise the effective insecticide DDT turned out to be very harmful to the environment as well.

Responsible Innovation is an emerging concept that aims to prevent or deal with problems that arise with innovation. This is done by taking social and ethical aspects into account and by balancing economic, socio-cultural and environmental aspects (Blok and Lemmens 2015). Burget et al. (2017) state that "*Responsible Innovation is essentially an attempt to govern research and innovation in order to include all the stakeholders and the public in the early stages of research and development. The inclusion of different actors and the public is, in turn, meant to increase the possibilities to anticipate and discern how research and innovation can or may benefit society as well as prevent any negative consequences from happening*" (p. 15).

Responsible Innovation borrows processes and tools from work in Bioethics, Technology Assessment and Ethical, Legal and Social Aspects (ELSA) (Burget et al. 2017). These approaches do not study the whole spectrum of purposes, processes, products and implications of the innovation, but they primarily investigate the research stage while often overlooking the important final stages of innovation, such as commercialisation. The added value of Responsible Innovation in comparison to ELSA is that it focuses on economic valorisation, industry collaboration and socio-economic benefits (Zwart et al. 2014). Van den Hove et al. (2012) argue that Responsible Innovation goes beyond creating just economic growth, as it aims at benefitting people by meeting their needs and by providing economic, environmental and social sustainability.

The concept of Responsible Innovation in a business context faces three major challenges. First, Responsible Innovation lacks definition and clarity. It is a 'big word' that gives some direction but its contents are flexible and open (Bos et al. 2014). Correspondingly, the boundaries between the different underlying dimensions of the Responsible Innovation framework are blurred (Owen et al. 2013). Second, empirical research in the field of Responsible Innovation is lacking (Blok et al. 2015). This is because this field of research is relatively new, and was introduced in a top-down manner by policy makers (Burget et al. 2017), and is defined and understood in different ways (Bos et al. 2014; Burget et al. 2017). Third, Responsible Innovation has a narrow view on innovation as it focuses on science (Lettice et al. 2013) and technological development (Ribeiro et al. 2016) and fails to include commercialisation (Pellé and Reber 2014). This is remarkable because

commercialisation is an essential stage of an innovation process and also, most innovations take place in the private sector (Baregheh et al. 2009). Consequently, it is still unknown what the concept of Responsible Innovation entails in the business context (Blok and Lemmens 2015).

We suggest that previous work on social innovation and sustainable innovation is used to advance the concept of Responsible Innovation in the business context. One reason is that social- and sustainable innovation are already embedded in the business context. Social innovation research has been more practice-oriented and predominantly studied in the context of entrepreneurship (Choi and Majumdar 2014), while corporate sustainable innovation has already received considerable attention from researchers, managers, and policy makers (Adams et al. 2016). Second, we argue that social- and sustainable innovation are conceptually overlapping with Responsible Innovation, since each of these three innovation approaches is considered to involve innovations *for* society and *with* society.

In this chapter we analyse where the current concept of Responsible Innovation shares conceptual similarities and dissimilarities with social innovation and sustainable innovation with regard to: the *inputs* for innovation, the innovation *processes*, and the subsequent *outputs* and implications of these innovations for society. At the conclusion of this study we synthesize the results and lay the basis for the concept of Responsible Innovation in the business context. Our aim is to inspire future research on Responsible Innovation in the business context by shifting the discussion from responsible science towards Responsible Innovation. Consequently, three research questions need to be answered:

In what way is Responsible Innovation conceptually overlapping with social- and sustainable innovation in regard to purpose, process, products and implications of the innovation?

In what way is Responsible Innovation conceptually distinctive from social- and sustainable innovation in regard to purpose, process, products and implications of the innovation?

What do these conceptual similarities and dissimilarities mean for our understanding of Responsible Innovation in the business context?

Since social- and sustainable innovation are defined in different ways by different streams of researchers, we argue that our proposed concept of Responsible Innovation should not be based on just a limited set of definitions. We expect that literature reviews of responsible-, social- and sustainable innovation research provide better insights of the different perspectives on each of these concepts. Therefore, this chapter contains a conceptual analysis of literature reviews and does not involve a meta-analysis or empirical research.

The remainder of this chapter is structured as follows. In the Literature Review, the concepts of responsible-, social- and sustainable innovation are explained with information from review articles. First, the concept of Responsible Innovation is explained, which is followed by a section where the concept of social innovation is explained. Subsequently, the conceptual similarities and dissimilarities between responsible- and social innovation are presented. The same structure is followed for sustainable innovation. In the final section we will integrate these findings and develop our understanding of Responsible Innovation in the business context.

11.2 Responsible Innovation

11.2.1 Input of Responsible Innovation

Responsible Innovation is a new and upcoming concept triggered by the call for innovations that respond to the grand challenges of our time (Von Schomberg 2014) such as climate change, food security and poverty. The innovation that is necessary for finding solutions comes with uncertainties regarding their development and their future implications (Stilgoe et al. 2013). These complex challenges or 'wicked problems' can be seen as inputs for Responsible Innovation (Blok and Lemmens 2015).

The future implications of innovations cannot always be predicted during the development of the innovation. Responsible Innovation acknowledges this inherent uncertainty and it aims to achieve governance of the innovation to accommodate the uncertainty of future implications (Stilgoe et al. 2013). Other reasons to initiate Responsible Innovation can be due to public policy demands, to increase the odds of public acceptance, to better foresee possible implications, to deliver societal benefits and to develop better novel practices (Ribeiro et al. 2016).

11.2.2 Throughput of Responsible Innovation

Owen et al. (2012) and Stilgoe et al. (2013) developed a more democratic governance framework for innovation that is based on contemplating the purpose(s) of the innovation instead of focusing on avoiding detrimental implications (Ribeiro et al. 2016). More specifically, stakeholders and members of the public are involved early in the innovation process to deliberate about the innovation at stake, which helps innovators to think carefully about the purpose of the innovation. Furthermore, the deliberation should involve discussions on how the development of the innovation can be responsive to the inherent uncertainties that come with innovation. Hence, their anticipatory governance of innovation is based on a collective duty of care that requires alternative constructions of (co-)responsibility (ibid.).

Von Schomberg (2012) has a similar focus on a democratic governance of innovation and defines the process Responsible Innovation (i.e. the throughput) as:

> … a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)"(Von Schomberg 2012, p. 9).

It is widely acknowledged that there are several conceptualisations and definitions of responsible (research and) innovation (e.g. Burget et al. 2017; Gianni and Goujon 2014; Wickson and Carew 2014). Accordingly, there are multiple approaches developed for Responsible Innovation, for example approaches that focus on

evaluation of the benefits, impacts, unanticipated risks and ethical implications of the innovation (e.g. Technology Assessment). However, the framework developed by Owen et al. (2012) and Stilgoe et al. (2013) is one of the most dominant approaches in Responsible Innovation (Ribeiro et al. 2016). Furthermore, the systematic literature review by Burget et al. (2017) identified four dimensions that are recurring throughout the literature on Responsible Innovation. These are the same four dimensions that comprise the framework for Responsible Innovation developed by Owen et al. (2012) and Stilgoe et al. (2013): anticipation, reflexivity, inclusion, and responsiveness. These four dimensions are further discussed as they are considered to be key for the throughput of Responsible Innovation.

Anticipation involves system thinking about any known, likely, plausible and possible implications of the innovation that is to be developed (Stilgoe et al. 2013). It plays an essential role in the beginning of the innovation, and requires that the actors involved in the innovation understand the dynamics that help to shape the innovation (Burget et al. 2017). Furthermore, the complexities and uncertainties that come with innovation are acknowledged and explicitly taken into account (Stilgoe et al. 2013). Therefore, the 'imaginations' of future implications do not serve to predict futures, but to envision desirable futures and organise resources to meet those desirable futures. The challenge here is to make certain imaginations more concrete while at the same time being receptive for other views. This needs to be done at a time when it can be constructive, but not too late to adjust the innovation (ibid.). This requires early inclusion of stakeholders and the wider public who engage in *"a dedicated attempt to anticipate potential problems and assess available alternatives"* (Wickson and Carew 2014, p. 2).

Reflexivity is about critically scrutinising one's own activities, commitments and assumptions, and being aware of the limits of knowledge and the fact that one's reality might not be universally held (Stilgoe et al. 2013). Innovators need to reflect on their value systems and theories and how these affect the development of the innovation. Furthermore, innovators need to blur the lines between their role responsibility and their wider moral responsibilities (ibid.). Wickson and Carew (2014) found that reflecting on underlying values, assumptions and beliefs, was a recurring theme in the different conceptualisations of Responsible Innovation, which can be enhanced by early inclusion of stakeholders and the public.

Inclusion is the dimension that comes back in all articles on Responsible Innovation as it is vital for proper implementation of the other three dimensions (Burget et al. 2017). Inclusion is the actual involvement of stakeholders and the wider public via dialogue or other ways to enhance the democratic governance of innovation. Aspects of Inclusion are intensity, openness, and quality of the discussion. Actors have to initiate discussions and to question the social, political and ethical implications of the innovation (Stilgoe et al. 2013). One could say that Responsible Innovation involves an *"active engagement of stakeholders for the purpose of substantively better decision-making and mutual learning"* (Wickson and Carew 2014, p. 2).

Responsiveness is having the capacity to change shape or direction in response to values of stakeholders, values of the wider public and changing circumstances.

Furthermore, it is about actually adjusting courses of action while recognising the insufficiency of knowledge and control, and responding to new knowledge, perspectives, views and norms that emerge when innovating. This in turn requires a collective institutionalised response and co-responsibility for responsible development of the innovation (Owen et al. 2013). Or as Wickson and Carew (2014, p. 2) put it: *"a willingness among all participants to act and adapt according to these ideas"*.

11.2.3 Output of Responsible Innovation

When it comes to the output of Responsible Innovation, we have to consider the actual products of the innovation process and their implications for society. It is clear from the reviews (Burget et al. 2017; Ribeiro et al. 2016) that the output of Responsible Innovation processes are primarily considering science and technological development. However, Blok and Lemmens (2015) suggest that we should widen our conception of innovation and include non-technological innovation as well, such as social innovations.

The overall goal embedded in the different conceptualisations of Responsible Innovation is to take social and ethical aspects into consideration with regard to the development of the innovations (Ribeiro et al. 2016) and its marketable products (von Schomberg 2012). When it comes to the impacts of innovations, there are two approaches to determine whether the impact of an innovation can be considered 'responsible'. According to the procedural approach (e.g. Stilgoe et al. 2013), the stakeholders develop and agree upon norms and moral judgments by engaging in deliberation (Pellé and Reber 2014, p. 41). The rightness/goodness of norms depends on the quality of stakeholder inclusion and deliberation. These norms can be translated into conditions that the innovation outcomes and their impacts should meet. The substantive approach builds primarily on prior given norms and moral judgments to determine if the outcomes and impacts of innovation processes can be deemed responsible (ibid.). For example, Von Schomberg (2013) builds on the normative anchor points presented in the European Treaty (e.g. sustainable development, social justice and protection, equality, and sustainable economic growth). Translated into broad innovation requirements, it means that Responsible Innovations should be societally desirable, sustainable, and ethically acceptable (Von Schomberg 2013).

11.3 Social Innovation

Social innovation is anything but a new phenomenon (Mumford 2002) and most of the research and definitions of social innovation are introduced by people who solved practical problems, instead of scholars who developed social innovation

theory (Caulier-Grice et al. 2012). Consequently, publications on social innovation have been mostly practice-oriented (Choi and Majumdar 2014).

However, the term social innovation is nowadays commonly, but not consistently, used by scientists (Moulaert et al. 2005) as it is conceptualised and defined in different ways (Cajaiba-Santana 2014; Choi and Majumdar 2014). For example, the term social innovation is not only used as a synonym for (unintended) social change, but also for intangible innovations that are designed with an intention to achieve specific ends (Choi and Majumdar 2014). However, social innovation often takes part in the entrepreneurial context where it encompasses innovations that are "explicitly aiming at the creation of social value and thus at positive social change. Hence, in this case, the 'social' denotes that the purpose of social innovation is to meet pressing social needs and to improve human and environmental well-being" (Choi and Majumdar 2014, p. 27). For example innovations that result in better access to healthcare, education or equal opportunities for income generation (ibid.)

The fact that social innovation is conceptualised and defined in different ways by different schools of researchers is also observed by van der Have and Rubalcaba (2016) who conducted a systematic network- and bibliometric analyses of social innovation.[1] This multiplicity of research schools that hold different perspectives on social innovation makes it hard, if not impossible, to achieve a consensus on the meaning of the concept (Choi and Majumdar 2014). Therefore, we argue that it is more appropriate to do a conceptual analysis based on literature reviews on social innovation (e.g. Choi and Majumdar 2014; Sharra and Nyssens 2010; van der Have and Rubalcaba 2016) instead of doing a conceptual analysis based on a single definition of social innovation.

11.3.1 Input of Social Innovation

The purpose of social innovation is to enhance social- and/or environmental well-being by addressing social needs or by solving social problems (Choi and Majumdar 2014) that are not being met by government or market actors (Sharra and Nyssens 2010). Also Van der Have and Rubalcaba (2016) observed that social innovations aim to meet common goals, solve social (-technical) challenges, or address matters of local development. More specifically, they identified an academic community that views social innovations as solutions to social (-technical) challenges, primarily directed to sustainability of climate, environment and health provisions (ibid.).

[1] For more information regarding the history of social innovation as a scientific concept and how different scientific communities influenced the scientific discourse on the concept, please see Choi and Majumdar (2014) and Van Der Have and Rubalcaba (2016). Since this goes beyond the aim of this chapter, it is not thoroughly discussed here.

11.3.2 Throughput of Social Innovation

Regarding the process of social innovation, there are two distinct streams of researchers that have a process-oriented understanding of social innovation (Van Der Have and Rubalcaba 2016). Researchers who investigate social innovation from a community psychology perspective understand social innovation as a process for systemically introducing change in social systems to solve (complex) social problems. Researchers investigating social innovation from a creativity research perspective aim to understand how new ideas of social relationships and social organisation are developed to generate and implement solutions to meet a common goal (ibid.). These two schools were also identified by Choi and Majumdar (2014).

There is also a stream of researchers who focus on the role of social innovation in local development (Choi and Majumdar 2014; van der Have and Rubalcaba 2016). They understand social innovation as: "satisfying human needs through (an empowering) change in the relations between local civil communities and their governing bodies" (van der Have and Rubalcaba 2016, p. 1928). This cluster pays special attention to the role of institutions and inclusive forms of collaboration in social innovation processes (ibid.). That collaboration is important in social innovation becomes clear in the review Sharra and Nyssens (2010) who found that the major characteristic of the social innovation process is the involvement of "a complex network of formal and/or informal partnerships between various stakeholders" (Sharra and Nyssens 2010, p. 7). Likewise, Dawson and Daniel (2010, p. 16) describe social innovation as a "process of collective idea generation, selection and implementation by people who participate collaboratively to meet social challenges". Social innovation is seen a collective endeavour where innovators and stakeholders (primarily target beneficiaries) reflect upon the purpose and end of the social innovation (Choi and Majumdar 2014). Especially practice-led research regarding social innovation stresses a dual objective, namely developing innovative solutions for societal problems while at the same time making sure that societal stakeholders have the capacity to act (ibid.).

11.3.3 Output of Social Innovation

The review by Sharra and Nyssens (2010) revealed that all conceptions of social innovation outputs share the element of novelty, meaning that these innovations can be new to the user, context, or application. Social innovations are distinguished from inventions by the fact that they are 'in use' and contribute to human and social life (van der Have and Rubalcaba 2016) which is similar to market adoption that makes the difference between (technological) innovations and inventions.

Social innovations can be found along a formalisation continuum. On one end, one can find highly formalised social innovations that are well-defined and have specific properties (e.g. the ethical and modular smartphone by *Fairphone*). On the

other end of the continuum one finds social innovations that are less formalised. These less formalised social innovations (e.g. minority empowerment program) are consisting of several services and smaller interventions that are continuously adjusted in response to the target group who act as co-creators (Choi and Majumdar 2014). Furthermore, van der Have and Rubalcaba came to a similar observation as Choi and Majumdar (2014), which is that different streams of researchers investigating social innovation do support the idea that:

"[Social innovation] has an important commonality in sharing two 'core conceptual elements': [social innovation] encompasses 1) a change in social relationships, -systems, or -structures, and 2) such changes serve a shared human need/goal or solve a socially relevant problem" (van der Have and Rubalcaba 2016, p. 1932).

More specifically, Choi and Majumdar (2014) state that "the dimension of change processes points not only to sustainable and long-lasting, systemic changes induced by social innovations, but also to the contexts, settings, and their specific structures in which social innovations are embedded" (p. 30). However, like any other actor engaged in innovation, also social innovators can experience resistance coming from different interests and power relations, or changing roles and mental models (ibid.).

11.4 Similarities and Dissimilarities Between Responsible Innovation and Social Innovation

11.4.1 Input

Science and technological development alone will not be able to tackle grand societal challenges (Sabadie 2014). Therefore, social innovations are increasingly understood as means to solve grand challenges in societies (Benneworth et al. 2015). Therefore, supported by the systematic literature reviews on social innovation, we argue that the grand societal challenges of our times do not only function as inputs for Responsible Innovation but also for social innovation. Responsible Innovation is also initiated to accommodate the inherent uncertainty that comes with innovation. However, in the literature reviews we did not find any indications that this also holds for social innovation.

11.4.2 Throughput

Social innovation is partly overlapping with Responsible Innovation when it comes to anticipation. Social innovators aim to better understand the needs, dislocations, dissatisfactions and blockages of target beneficiaries, which subsequently helps in "generating ideas […] and identifying potential solutions" (Mulgan 2006, p. 149).

Subsequently, social innovators find ways to bring the social change that is necessary to solve social problems that the people face (Sharra and Nyssens 2010). Social innovation seems to be less engaged in foreseeing detrimental implications that the innovation could bring.

Social innovation does reflect on the purpose for innovation and the ends that they want to achieve (Choi and Majumdar 2014). Furthermore, successful social innovators reflect on their actions and commitments as they evaluate the actual impact of their social innovations (Mulgan 2006). However, in the literature reviews we did not find any indications that social innovators engage in second-order reflexivity, meaning that they reflect how their own theories and value systems have an influence on the development of their social innovation. This is where Responsible Innovation differs from social innovation, as Responsible Innovation aims to increase awareness of different perceived realities and value systems between stakeholders and innovators.

Social- and Responsible Innovation particularly stress the importance of stakeholder inclusion, especially the people who might be affected by the innovation. However, there are differences between social- and Responsible Innovation when it comes to the reasons for stakeholder inclusion. Social innovation involves stakeholders primarily for better understanding the social problem or the societal needs that have to be addressed by the innovation. The same holds for Responsible Innovation, but in addition Responsible Innovation includes stakeholders also to facilitate more pluralistic visions of the implications innovation (Ribeiro et al. 2016). This should not only involve envisioning beneficial implications but also possible detrimental implications. Furthermore, it seems that social innovation does not aim to involve all relevant stakeholders during an innovation process, as it primarily focuses on co-creation with its target beneficiaries. Besides, social innovation does not involve stakeholders to question the desirability of social change and enhanced social- and/or environmental well-being.

When it comes to responsiveness Mulgan (2006) found that successful social innovations are developed by engaging in trial-and-error, experimenting and following hunches; followed by developing, prototyping, and piloting first versions of the solution for further improvement. Social innovation often involves a collective response by stakeholders who cooperatively generate, select and implement ideas to solve a social problem (Dawson and Daniel 2010; Sharra and Nyssens 2010). Social innovations are continuously adapting to the context in which they are developed, and to the needs of its target beneficiaries who act as co-creators (Choi and Majumdar 2014). Target beneficiaries are especially involved as co-creators for social innovations that are less formalised.

11.4.3 Output

Responsible Innovations and social innovations are both revolving around novel solutions that can take many forms. However, Responsible Innovation is primarily involved in the governance of science and technological development (Benneworth et al. 2015), whereas social innovation is about developing innovations that result in the social change necessary for solving social problems. Therefore, social innovation could be informative for opening-up the narrow view on innovation that can be found in Responsible Innovation research. Furthermore, researchers in social innovation distinguish social innovations from social inventions by stating that the latter are not in use. This cannot be said for the current notion of Responsible Innovation, which does not differentiate between responsible science and technological development. Hence, Responsible Innovation could also involve inventions by scientists that are not turned into marketable products yet.

11.5 Sustainability-Related Innovation

There is a rather diverse knowledge base coming from research on innovations that address sustainability, which includes concepts like green-, eco-, environmental- and sustainable innovation. These concepts are used interchangeably (Schiederig et al. 2012) even though there are different research communities that provide different lenses on how to innovate for sustainability (Franceschini et al. 2016).[2] Schiederig et al. (2012) identified six aspects that are recurring in the different definitions of sustainable innovation concepts.

1. Sustainable innovations can appear in different forms like products, processes, services or business models.
2. Sustainable innovations have a market orientation, meaning that they satisfies needs and are competitive on the market.
3. Sustainable innovations should reduce environmental impact, preferably have no environmental impact
4. The full life-cycle of the innovation should be considered when assessing the sustainability effect of the innovation.
5. Sustainable innovations can be driven by economic or ecological motivations.
6. Sustainable innovations can set new standards of sustainability for firms.

[2] For more information regarding the history of sustainable innovation as a scientific concept and how different scientific communities influenced the scientific discourse on the concept, please see Franceschini et al. (2016) and Schiederig et al. (2012). Since this goes beyond the aim of this chapter, it will not be thoroughly discussed here.

11.5.1 Input of Sustainability-Oriented Innovations

Sustainability-oriented innovation processes are initiated to pursue sustainable development. The International Union for Conservation of Nature (IUCN) was first to introduce the term 'sustainable development' and defined it as *"the integration of conservation and development to ensure that modifications to the planet do indeed secure the survival and well-being of all people"* (Schiederig et al. 2012, p. 181). More specifically, sustainable innovation is driven by grand challenges such as: increasing energy consumption, climate change, dependency on fossil fuels, pollution and water shortages (Charter and Clark 2007). The motivations to address the grand challenges can be driven by social or environmental motivations, but also economic motivations as companies can see potential competitive advantages by responding to the grand challenges (ibid). The latter is more present in research on 'green innovation' that relates sustainable innovation more directly to management and competition objectives (Franceschini et al. 2016).

11.5.2 Throughput of Sustainability-Oriented Innovations

Adams et al. (2016) conducted a systematic literature review to identify, analyse and synthesise sustainability-oriented innovation practices and processes at firm-level. They argue that firms can engage in sustainable innovation on three different levels. Firms at the lower level are engaging in 'operational optimisation' and have an:

"internally oriented perspective on sustainability, referring to a 'doing the same things but better' approach directed toward reducing harm through reactive, incremental improvements driven by compliance or proactively pursuing efficiencies. These are activities characteristically technical, stand-alone and insular" (Adams et al. 2016).

These companies could be of primary interests to scientists engaged in 'eco-innovation', as Franceschini et al. (2016) found that these scientists investigate issues around technology design and products that primarily lead to efficiency gains. Since Responsible Innovation aims to go beyond compliance (Stilgoe et al. 2013), we do not consider this level of sustainable innovation to be relevant for Responsible Innovation.

Firms at higher levels of sustainable innovation operate closer to the ideal of Responsible Innovation. Adams et al. (2016) state that at a higher level of sustainable innovation, firms include the social aspect into the notion of sustainability as well. The 'organisational transformers' involve companies that engage in innovation activities that are more people-oriented. Furthermore, their sustainability-oriented innovations are not treated as insular events, and the idea of sustainability is embedded throughout the firm and preferably along the value chain. A small but growing number of firms go even further and make a more radical shift in philosophy. These firms aim to think beyond the firm by reflecting with other stakeholders,

including the public, on the role of their business and its innovations for a desirable future. These so-called 'system builders' focus more on developing networks of workable relations, including unconventional stakeholders and the public, who collaboratively create sustainability value. Such novel collaborations are important for engaging in dialogue, gaining legitimacy, finding opportunities for knowledge acquisition, and finding opportunities for responsive solutions (Adams et al. 2016).

11.5.3 Outputs of Sustainability-Oriented Innovation

In the end, innovation processes result in sustainable innovations when the products, processes or business models have reduced negative externalities and preferably have no negative impact at all. In order to critically evaluate the impact of sustainable innovation, it is required that one takes the full life-cycle of the innovation into account (Schiederig et al. 2012).

The final outcomes of sustainability-oriented innovations can appear in many forms since they can be technological (like in eco-innovation), related to services (also known as servitisation), but also systems-shaping innovations that consist of interconnected sets of innovations (Mulgan and Leadbeater 2013). The implications of systems-shaping innovations are that they shift cities, sectors, economies or other systems on a more sustainable path (Draper 2013), which is necessary when addressing grand challenges.

11.6 Similarities and Dissimilarities Between Responsible Innovation and Sustainable Innovation

11.6.1 Input

Grand societal problems or 'wicked problems' are not only inputs for responsible- and social innovations but also for sustainability-oriented innovations. This holds especially for system-shaping sustainable innovations, which are necessary for responding to grand challenges that are too large for single firms to solve on their own. Again, Responsible Innovation aims to accommodate for the uncertainty that innovations could have negative implications. However, in the literature reviews we did not find any indications that this also holds for sustainable innovation.

11.6.2 Throughput

Adams et al. (2016) state that organisations that start developing systems-shaping innovations initiate, mobilise, inspire and lead the change towards workable relationships with private, public and civil society partners. These workable

relationships are not only important for constructive dialogues to collectively define the problem, but they are also beneficial for knowledge acquisition and the search for solutions (Mirata and Emtairah 2005). Furthermore, the discussions with stakeholders aim to steer innovations in the right directions by discussing the role that the firm and its innovations can play in desirable futures (Adams et al. 2016).

Organisations engaging in sustainability-oriented innovations do reflect on the outcomes of their innovations. Successful firms reflect on their actions and commitments by measuring and disclosing the impacts of the innovation. Furthermore, organisations reflect on the role that they can play in developing system solutions for complex grand challenges that they cannot solve on their own. These organisations are:

> *"leaving behind the prevailing economic paradigm to reframe the purpose of the firm in society: a part of society, not apart from it". […] "They adopt a logic of collaboration and invest in system solutions to derive new shared value propositions from the entire socio-technical and ecosystem network to make a positive impact" (*Adams et al. 2016*, p. 192).*

It is therefore fair to assume that those organisations that are engaged in finding systems-shaping solutions think beyond their role responsibilities and reflect on their wider moral responsibilities as well, which is also a core characteristic of reflexivity in Responsible Innovation (Stilgoe et al. 2013).

Sustainability-oriented innovators engage in dialogues with stakeholders beyond their supply-chain, such as civil society actors and unconventional stakeholders like community action groups or social entrepreneurs. However, also important differences could be observed. While these stakeholders are included in sustainable innovation to better define the problem and its possible solutions, the literature does not suggest that they question the social, political and ethical implications of possible solutions. Therefore, it seems that the discussion focuses on desirable implications of sustainable innovation, while possible detrimental implications receive negligible attention.

Again, innovations involving operational optimisation are predominantly developed in response to legislation and regulation (Adams et al. 2016), which is not similar to responsiveness as it is understood in Responsible Innovation literature. Organisations engaged in organisational transformation or system-building innovations for sustainability, are more inclined to develop innovations that require mutual learning and collective problem solving (Adams et al. 2016). Firms are more successful in developing sustainable innovations if they are more responsive to weak signals coming from their immediate stakeholder environment. Not only does this require absorptive capacity and connections with stakeholders, but also proper internal knowledge management processes. Without proper knowledge management processes, firms will fail to develop system-changing solutions even though they do engage in stakeholder collaborations (Ayuso et al. 2011). While Responsible Innovation does acknowledge the importance of internal knowledge management processes, it remains underexposed in Responsible Innovation literature. It is even

less discussed how to manage such processes. Seebode et al. (2012) found that organisations that want to develop system-shaping solutions need to learn how to follow novel pathways, how to work with other stakeholders, and how to find new ways of knowledge management. The advantage of sustainable innovation literature is that there is more practice-based information how organisations can engage in organisational learning, which remains underexposed in Responsible Innovation literature.

At the highest level of sustainable innovation, stakeholders are consulted during the earliest stages of innovation to find out how firms and innovations can play a role in desirable futures. However, the reviews did not provide any information how firms proceed after this initial stage. Therefore, it remains unknown whether innovators and stakeholders are mutually responsive throughout the innovation process. Research by Blok et al. (2015) confirms a tendency by firms to be transparent towards stakeholders and to deliberate with them during the initial stages of the innovation process and close to implementation of the innovation, but not during the stages in between. Therefore, there are no indications that sustainable innovation is a fully democratic and transparent innovation process like the ideal of responsible research and innovation aims to be.

11.6.3 Outputs

Sustainable innovations at a lower level focus on operational optimisation, which often result in technology-based innovations that lead to efficiency gains (Adams et al. 2016). However, recent sustainability oriented innovations increasingly involve systems-shaping solutions that consist of "interconnected set[s] of innovations, where each influences the other, with innovation both in the parts of the system and in the ways in which they interconnect" (Mulgan and Leadbeater 2013, p. 4). Adams et al. (2016) links this observation to Draper's conception of sustainability, which can be seen as "set of actions that shift a system – a city, a sector, an economy – onto a more sustainable path" (Draper 2013, p. 11). Therefore, the similarity is that both responsible- and sustainable innovation involve complex innovations that enhance sustainable development.

However, the review by Adams et al. (2016) does not provide any evidence that sustainability-oriented innovations explicitly account for the normative anchor points of responsible research and innovation like social justice, equality, and sustainable economic growth. Adams et al. (2016) state that some sustainability-oriented innovators even aim to depart from the economic paradigm. Therefore, future research could investigate what the role of these different normative anchor points are for innovation in the business context (Table 11.1).

Table 11.1 Overview of the conceptual overlap and the differences between responsible-, social- and sustainable innovation

	Responsible innovation	Social innovation	Sustainable innovation
Input for innovation	The grand challenges (Burget et al. 2017; Von Schomberg 2014; Wickson and Carew 2014)	The Social needs and problems that are not being met by the government or market actors (Choi and Majumdar 2014; Mulgan et al. 2007)	The climate-related grand challenges (Charter and Clark 2007) that are often complex (Adams et al. 2016)
	The uncertainty regarding innovations' future impacts (Stilgoe et al. 2013)		The business opportunity to increase profits by developing a sustainable innovation (Adams et al. 2016; Franceschini et al. 2016; Schiederig et al. 2012)
	The embedding of innovation in society (Ribeiro et al. 2016 and von Schomberg 2014)		
Throughput of innovation (i.e. the process)	Taking into account innovations implications and assessing alternatives (Wickson and Carew 2014)	Collectively defining the problem and searching for solutions (Mulgan 2006) and understanding the implications of social innovations (Sharra and Nyssens 2010)	Comparing different innovations' impacts based on full life-cycle assessments (Schiederig et al. 2012) and engaging in scenario thinking (Adams et al. 2016)
	Reflecting on the effect of the underlying norms, values and beliefs on the innovation at stake (Stilgoe et al. 2013)	Deliberating by consulting whether the needs of target beneficiaries are met	Deliberating with stakeholders how the firm and its innovations can help to achieve system transformation for desirable futures (Adams et al. 2016).
	Deliberating with stakeholders about the underlying norms and values that should guide the innovation in the desirable direction	Assuming that values such as social equality and sustainability are desirable and translating them into innovation requirements	Reducing the environmental harm per unit(lower level). Including the social dimension in to sustainability next to environmental- and economic dimensions (medium level). Deliberating with stakeholders what desirable futures are and what role the firm & innovation could play (high level) (Adams et al. 2016).
	Or normative anchor points of the European Treaty are used as normative goals for Responsible Innovation		
	Reflecting on activities, commitments and assumptions (Stilgoe et al. 2013)	Reflecting on the social impact and setting of new goals (Mulgan 2006)	Assessing the impact of the innovation over its full life-cycle (Schiederig et al. 2012) and disclosure of its sustainability performance (Adams et al. 2016)
	Reflecting on wider moral responsibilities next to role responsibilities (Stilgoe et al. 2013)	Taking responsibility to solve societal needs and problems that others do not address (Choi and Majumdar 2014)	Reframing the purpose of the firm from being apart from society to being part of society (high level) (Adams et al. 2016).

	Involving and deliberating with the relevant stakeholders throughout a transparent innovation process (Von Schomberg 2012) to make better decisions and learn from each other (Wickson and Carew 2014).	Including stakeholders (primarily target beneficiaries) for better understanding of the addressed social need or problem (Sharra and Nyssens 2010; Choi and Majumdar 2014).	Including stakeholders to increase the knowledge base of the firm, to improve search activities, to enhance social legitimacy, and to develop responsive solutions (Adams et al. 2016). Helps to enhance mutual learning (Boons et al. 2013) and improve decision-making (Bos-Brouwers 2010).
	Engaging with stakeholders in general and members of the public in particular (Owen et al. 2012; Stilgoe et al. 2013)	Deliberating with stakeholders in general and the target beneficiaries in particular (Mulgan 2006; Sharra and Nyssens 2010; Choi and Majumdar 2014)	Engaging with supply-chain partners [lower level]. Engaging with stakeholders that represent the innovation system during the earliest stages of the innovation process [higher level]. Members of the public are seldom involved to enhance foresight (Adams et al. 2016).
	Acting and adapting to the results from stakeholder inclusion and deliberation (Wickson and Carew 2014)	Generating, selecting and implementing innovative ideas with other actors to meet social challenges (Dawson and Daniel 2010).	Realising mutual responsiveness among supply chain actors [lower level].
		Less formalised innovations are developed and adjusted according to the innovation context and needs of target beneficiaries (Choi and Majumdar 2014).	Realising responsiveness by developing an innovation agenda that responds to the desirable futures projected by involved stakeholders [higher level]. (Adams et al. 2016)

(continued)

Table 11.1 (continued)

	Responsible innovation	Social innovation	Sustainable innovation
Output for innovation	Innovations that are societally desirable, sustainable and ethically acceptable (Von Schomberg 2014)	Innovations that enhance social- and/or environmental well-being (Choi and Majumdar 2014; Sharra and Nyssens 2010).	Innovations with reduced environmental impact on society, preferably none (Chalmers 2013; Schiederig et al. 2012) that balances social-, environmental- and economic considerations.
	Predominantly new and emerging sciences and technologies.	Innovations that induce the social change necessary for addressing the societal need or problem (Choi and Majumdar 2014) that are already implemented in practice (van der Have and Rubalcaba 2016)	Sustainable innovation goes beyond technological solutions and increasingly involves services and business-model and organisational innovation (Adams et al. 2016; Boons and Lüdeke-Freund 2013)
	Along a formalisation continuum from tangible (e.g. drones) towards intangible (e.g. financial products, GMO, etc.)	Social innovations can be found along a continuum of specificity of the innovation's properties & characteristics	Not only technology-based innovations but also other innovations. Sometimes sustainable innovation consists of a set of interrelated innovations (Adams et al. 2016) that shift a system onto a more sustainable path (Draper 2013)

11.7 Discussion and Conclusions

The aim of this chapter was to identify conceptual similarities and differences between Responsible Innovation and social- and sustainable innovation, and what this means for Responsible Innovation in the business context. Due to the multiplicity of conceptualisations and definitions that can be found in each of the three innovation concepts, we considered it legitimate to base our conceptual analysis on literature reviews of responsible-, social- and sustainable innovation. The research objectives of the literature reviews that were consulted were different. For example, literature reviews aimed at analysing and synthesising innovation activities (e.g. Adams et al. 2016) explicate the different understandings of innovation between scientific schools (such as Franceschini et al. 2016 and van der Have and Rubalcaba 2016) or aimed at outlining the characteristics of innovation in different contexts (e.g. Choi and Majumdar 2014).

The findings from our conceptual analysis indicate that social- and sustainable innovation are conceptually overlapping with Responsible Innovation on several aspects of the input, throughput and output of innovation. However, the explicit focus on determining the underlying norms and values for innovation is what discriminates Responsible Innovation from social- and sustainable innovation. These underlying norms and values for Responsible Innovation can be determined based on the results of deliberation with all relevant stakeholders (i.e. procedural approach) or they can be predetermined (i.e. substantive approach).

The conceptualisations in the literature reviews of social and sustainable innovation indicate that both innovation concepts are primarily based on the substantive approach. For example, it is predetermined that social innovation encompasses innovations that create social change to serve a shared human need or to solve a societally relevant problem, which subsequently enhances social and/or environmental well-being (Choi and Majumdar 2014; van der Have and Rubalcaba 2016). Even though there is deliberated whether the societal needs are met, the aim of the deliberation is not to discuss values such as social equality and sustainability. It is also not deliberated whether values can be conflicting, or how values are translated into innovation requirements. Similarly, 'sustainability' revolves around reduction of environmental impact for the lowest level of sustainable innovators, whereas at the medium level the social dimension is included as well. However, a small, but growing, number of sustainable innovators involve stakeholders for consultation. Here they reflect on the role that the firm and its innovations could play in a future desirable society (Adams et al. 2016). While this approaches the ideal of Responsible Innovation, the reviews did not reveal if and how the innovation agendas of the firms are responsive to the stakeholders. One can question whether such consultation without formal vote or say is in accordance with the deliberative democracy that Responsible Innovation aims to achieve. While one can argue if such a democratic governance of innovation is desirable in societies outside Europe and North-America (Macnaghten et al. 2014) the major challenge is how to achieve democratic governance of emerging science and innovations (Stilgoe et al. 2013).

We argue that it is highly questionable whether a democratic governance of innovation in the business context could be achieved in our current political and socio-economic system. First of all, because one cannot expect that companies become transparent during innovation as it will jeopardize the information asymmetries on which their market opportunities depend (Blok and Lemmens 2015). Second of all, inclusion of all relevant stakeholders is questionable, because Responsible Innovations respond to grand challenges that involve a wide variety of stakeholders (Weber and Khademian 2008). In reality, companies can only manage a limited number of different stakeholders in their network (van Geenhuizen and Ye 2014). Third of all, the final decision-making authority regarding the innovation strategy is restricted to the company (Blok and Lemmens 2015) as the board is responsible for the return on investment, and has to act on behalf of its shareholders and serve shareholder interests. This dominant role of shareholders is even embedded in corporate law (Heath 2011). Hence, it is questionable if all stakeholders can be treated alike, not to mention if a company can be responsive to the demands of all stakeholders. In conclusion, since we question the possibility to meet the requirement of a democratic governance of innovation in the business context, and since we did not encounter it in the literature reviews on social- and sustainable innovation, we propose not to consider democratic governance as a necessary condition for Responsible Innovation in the business context.

Another reason why Responsible Innovation is dissimilar to social- and sustainable innovation is that it requires stakeholders to reflect on the innovation trajectory and on how this trajectory could be made responsive to the inherent uncertainty that comes with innovations. Even though Stilgoe et al. (2013) proposes that Responsible Innovation should not focus on negative implications (Ribeiro et al. 2016), it seems that it is still a point of difference between Responsible Innovation and social- and sustainable innovation. Therefore, we propose that the procedural approach that can be found in the current notion of Responsible Innovation should also apply for Responsible Innovation in the business context.

However, there are important similarities between Responsible Innovation and social- and sustainable innovation. For example, responsible-, social-, and sustainable innovation provide insights how innovations can be developed that respond to the grand challenges, which can subsequently enhance social and/or environmental well-being. Social innovation is for example informative for finding out how to be responsive to the needs of target beneficiaries and how to co-create with them. Sustainable innovation is informative for developing system-changing solutions that respond to grand challenges, while taking the social-, environmental- and economic considerations into account. We see two reasons why social- and sustainable innovation can function as ‘points of departure’ for our understanding of Responsible Innovation in the business context. First, because the results of our analysis indicate that social- and sustainable innovation are conceptually overlapping with Responsible Innovation on multiple aspects regarding the input, throughput and output of innovation. Second, because research regarding social- and sustainable innovation is more practice-oriented and more embedded in the business context than Responsible Innovation.

Based on evidence presented in the reviews on social- and sustainable innovation we derive two essential preconditions for effective implementation of Responsible Innovation in the business context. These preconditions are based on the innovation practices of system-building firms that are described in the review by Adams et al. (2016), as these firms are currently innovating closest to the ideal of Responsible Innovation.

First of all, firms need to diffuse the notion of sustainability throughout the firm, and consider themselves part of society and not apart from it. This requires that the values and aspirations of the board and the owners are in line with the notion of sustainability. This notion is that sustainability is not an attribute of a single firm, instead it can only be applied at systems level, which requires collaboration with actors from private industry, public sector and involves civil society partners and investment in systems solutions. This new approach to innovation needs to be communicated throughout the firm, and integrated in the incentives and reward systems of employees (Adams et al. 2016; Armstrong et al. 2012). These actions ensure that Responsible Innovation becomes part of the company culture (Armstrong et al. 2012). Social- and sustainable innovation literature can inform how this could be achieved at strategic and operational level. This is necessary since new research (Blok et al. 2017) shows the discrepancy between the implementation of Responsible Innovation at the strategic level and at the operational level in companies.

The novel collaborations with a variety of stakeholders help to engage in dialogue, gain social legitimacy, find opportunities for acquiring new knowledge, and also help to find creative and responsive solutions. However, even though firms might engage in stakeholder collaborations, they will fail to develop system-changing solutions if there is a lack of internal knowledge management processes (Ayuso et al. 2011). The stakeholders need to learn how they can find, form and perform within the new innovation systems (Adams et al. 2016). This can be done by experimenting and learning with new approaches to sustainability, while simultaneously maintaining the existing business model. This allows firms to adjust the knowledge management processes without risking their business model, while at the same time developing an effective management approach that integrates foresight and novel collaborations with stakeholders (ibid).

Which consequences does our proposal have for the concept of Responsible Innovation in the business context? In Responsible Innovation in the business context, anticipation is similar to the understanding of anticipation in Responsible Innovation literature. Anticipation in Responsible Innovation in the business context therefore involves proactive engagement in activities enhancing foresight that take place at the start of the innovation process (Stilgoe et al. 2013). Anticipation is about better understanding the dynamics between the innovation and the wider eco-system in which it is developed and implemented. This also requires that stakeholders are involved in the discussion about what they consider to be desirable futures, and what the roles are of the firm and its innovations in those futures (Adams et al. 2016). Additionally, it is important that not only the environmental and economic implications are taken into account, but also the social, political and ethical implications of the innovation. It is important to acknowledge that stakeholder inclusion

and enhanced reflexivity does not necessarily lead to ethical outcomes and justifications (Pellé and Reber 2015) especially because it is unlikely that a democratic governance of innovation takes place in the business context. Furthermore, Responsible Innovation should still take into account that innovation can have unforeseen negative implications as well. Adopting a more procedural approach whereby the norms and values guiding the innovation are scrutinised by others than the innovators themselves, could help to become aware of the socio-political and ethical implications of innovation. Unfortunately, the literature reviews did not reveal any information on how this can be achieved effectively when innovating in the business context.

Reflexivity in the business context consists of two components. The first is measuring and disclosing the impact of the innovation, which can subsequently act as a driver for enhancing the performance of the innovation (Adams et al. 2016). This means that one assesses how the innovation performs compared to the desirable implications that were discussed at the start of the innovation process. The second is reflecting on the firm's role responsibilities but also its wider moral responsibilities. Firms need to be aware that they are part of society and not apart of it. However, the reviews did not provide insights whether companies investigate how their value systems and theories influence the subsequent development of their innovations. Furthermore, they did not reveal if companies assess whether their processes of anticipation, reflexivity, inclusion and responsiveness are in line with public values. Therefore we conclude that social- and sustainable innovation are not helpful for implementing this so-called second-order reflexivity as part of Responsible Innovation in the business context.

Firms involve stakeholders in their innovation process for three reasons. First, to achieve better foresight thinking, and to reflect on the role of the firm and their innovations in society (Adams et al. 2016). Second, to translate their underlying values for innovation into innovation requirements that result in innovation outcomes that are aligned with the needs of the target group. Third, to be able to adjust their innovation in response to new knowledge and changing stakeholder needs (Adams et al. 2016). In line with some findings in responsible- and sustainable innovation, we argue that foresight thinking and reflecting on the role of the firm (and their innovations) in society will be beneficial if such discussions take place with stakeholders that are representative for society. However, it is not likely that this is taking place throughout the innovation process, instead this more likely takes place at the start of the innovation process. Furthermore, as already mentioned before, it cannot be expected that this innovation process is transparent.

Also in the business context, firms aim to develop innovations that respond to grand societal challenges and they aim to make sure that the innovation becomes properly embedded in society. Hence it is essential to deliberate with stakeholders about the role of the firm and its innovations in a desirable future. Social innovation is primarily engaged with the target beneficiaries who can act as co-creators, whereas sustainable innovation aims to include representative stakeholders of the innovation system during the earliest stages of the innovation. What follows from the literature reviews is that firms should engage in good working relationships with

stakeholders as it allows them to quickly respond to 'weak signals' such as new knowledge or changing stakeholder needs and values (Holmes and Smart 2009). It is the responsibility of the company that aims to develop the innovation to initiate, mobilise, inspire and lead the change towards workable relationships with stakeholders in order to achieve such a mutual responsiveness. Furthermore, companies need to find new ways to develop proper internal knowledge management processes, as well as processes that help to develop innovations that respond to grand challenges and changing stakeholder needs.

Some final remarks have to be made with regard to the conclusions of this chapter. This chapter reflects on the concept of Responsible Innovation and critically examines what it could entail in the business context. This was done based on literature reviews regarding responsible-, social- and sustainable innovation for reasons explained throughout this chapter. However, it should also be noted that this approach has its drawbacks. For example, the literature reviews had different aims than this chapter, and were written from the perspective of social- or sustainable innovation, which is different from Responsible Innovation. These different aims and scientific lenses affect the analysis and synthesis of the literature, and subsequently the conclusions that are drawn in these literature reviews. Hence, it cannot be ruled out that relevant information for the concept of Responsible Innovation was omitted from the results and conclusions of these reviews. We further have to acknowledge that the business context is portrayed in this chapter as a homogeneous entity. This was done to contrast Responsible Innovation in the business context from the current notion of Responsible Innovation that focuses predominantly on science and technological development. However, we acknowledge that the business context is rather heterogeneous in practice. Nevertheless, we think that this chapter can serve as a starting point for further conceptualisation and subsequent implementation of Responsible Innovation in the business context. Therefore, it aims to inspire future work by researchers and practitioners who are interested in Responsible Innovation in general, and the business context in particular (Table 11.2).

Table 11.2 Overview of the main characteristics of the current concept of Responsible Innovation and the main characteristics of Responsible Innovation in the business context

	Responsible Innovation	Responsible Innovation in the business context
Anticipation	Proactive foresight activities to understand system dynamics between innovation and innovation eco-system	Proactive foresight activities to understand system dynamics between innovation and innovation eco-system
	Stakeholder inclusion to envision desirable futures to steer innovations in desirable direction	Stakeholder inclusion to understand the role of the firm and its innovations in desirable futures
	Being aware of possible negative (unforeseen) consequences	Being aware of possible negative (unforeseen) consequences

(continued)

Table 11.2 (continued)

	Responsible Innovation	Responsible Innovation in the business context
Reflexivity	Reflecting on norms, actions and commitments	Measuring of the innovation's performance and disclosure of the results
	Being aware of subjectivity of knowledge and that perceived realities are not universally held	Reflecting on wider moral responsibilities next to role responsibilities
	Reflecting on the effect of underlying value systems and beliefs on the development of the innovation	
Inclusion	Inclusion of all relevant stakeholders including members of the public	Inclusion of stakeholders representing the innovation system, the target beneficiaries and preferably members of the public
	Involvement of stakeholders throughout a transparent and interactive process	Openness towards involved stakeholders during the initial innovation stages and testing and launching the innovation. No transparency during the development of the business case and the innovation itself
Responsiveness	The innovators and involved stakeholders are responsive to the results ensued from anticipation, reflexivity and inclusion.	Translation of desirable futures into requirements for innovation
		Adjustment of innovation in the light of new knowledge and stakeholder needs, especially target beneficiaries
	Mutual responsiveness by being co-responsible for the development and implications of innovation	Focus on proper internal knowledge management processes
		Company remains primary decision-maker and responsible for the development of the innovation
Innovation output	Focus on science and technological advancements	Innovations that involve complex systems-shaping solutions (often consisting of interrelated sets of innovations)
	Innovation outcomes can be found along a formalisation continuum	
		Innovations can be found along a formalisation continuum

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Chapter 12
Exploring Ethical Decision Making in Responsible Innovation: The Case of Innovations for Healthy Food

Vincent Blok, Tjidde Tempels, Edwin Pietersma, and Léon Jansen

Abstract In order to strengthen RI in the private sector, it is imperative to understand how companies organise this process, where it takes place (throughout the entire company or on specific levels), and what considerations and motivations are central in the innovation process. In this chapter, the questions of whether and where normative considerations play a role in the innovation process, and whether dimensions of RI are present in the innovation process, are addressed. In order answer these research questions, a theoretical framework is developed based on Jones's theory of ethical decision making and Cooper's stagegate model of innovation management. In order to answer the research questions, a specific case of innovations that contribute to public health is explored, namely, that of food companies that participate in a Front-of-Pack (FoP) logo for healthier food.

As the use of healthy food logos does not necessarily have a positive impact on sales and profits (Jansen LAM, De Vos S, Blok V. Motives of retailers for healthy food innovation and communication about healthy food choices. Conference paper at the MVI conference, 25–26 August 2015, The Hague, 2015), it is expected that in the decision-making process, as part of their innovation process, companies make several trade-offs between economic, technical and moral factors (Jahromi MJ, Manteghi N, Procedia Technol 1:490–495, 2012). As the social-ethical values at

V. Blok (✉)
Management Studies Group, School of Social Sciences, Wageningen University, Hollandseweg 1, 6707 KN Wageningen, The Netherlands

Philosophy Group, School of Social Sciences, Wageningen University, Hollandseweg 1, 6707 KN Wageningen, The Netherlands
e-mail: vincent.blok@wur.nl

T. Tempels
Philosophy Group, School of Social Sciences, Wageningen University, Hollandseweg 1, 6707 KN Wageningen, The Netherlands

E. Pietersma
Management Studies Group, School of Social Sciences, Wageningen University, Hollandseweg 1, 6707 KN Wageningen, The Netherlands

L. Jansen
Dutch Choices Foundation, Bronland 12-S, 6708 WG Wageningen, The Netherlands

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stake in corporate innovation processes have remained to a large extent unexplored in research on innovation management, the aim of this chapter is to identify the motivations and barriers for companies embracing and continuing a FoP logo for healthier food, and to assess whether ethical considerations play a role in this innovation process. From the findings in this research, it will become clear that although the studied companies participated in a programme for healthy food and thus are responsive to the needs of society, and although the companies feel (partially) responsible for public health, ethical considerations do not play a central role in the operational innovation process. Instead, technical and economic considerations seem to prevail in the operational innovation process. Furthermore, none of the procedural dimensions of RI seems to be present at this level in the innovation trajectory. It is argued that this may be an indication that the ethical decision-making process for RI is not located at the level of the operational innovation process itself, but is something that might be located on a higher strategic level in the company. It is at this level that the moral decision is taken to adopt the FoP logo and to engage in the RI process. The findings cast a new light on the discourse on RI in general, and in the private sector in particular.

12.1 Introduction

In the wake of increasing lifestyle-related diseases like obesity, heart diseases and diabetes type 2, citizens, governments and civil society organisations are becoming increasingly concerned with the 'obesogenic' character of modern society. Over the past years, both governments and the general public have become increasingly aware of the impact that food consumption has on both public and individual health; a growing number of food consumers in western society no longer look only at the physical properties of food products, but are increasingly interested in the social, ethical, nutritional and environmental aspects of food (Van Loo et al. 2014).

In order to be responsive to the changed demands of society regarding healthy food, companies in the food sector are gradually taking responsibility for public health. Over the past years, the food industry has taken up a role in the prevention and mitigation of public health issues. These efforts move beyond general corporate social responsibility (CSR) practices, in which research and development (R&D) and innovation are often neglected, and primarily concern new product development[1]; a significant amount of the food sector's R&D budget is allocated to the reformulation of food products in order to reduce or substitute 'unhealthy' ingredients like sugar, saturated fatty acids and salt in food products (Roodenburg et al. 2011). These efforts can be understood as responsible innovation (RI), because, when innovating responsibly, corporate actors do not primarily try to achieve private economic goals, but rather to contribute to the solution of the grand challenge of lifestyle diseases (cf. Von Schomberg 2013).

[1] A comparison between CSR and RI is beyond the scope of this chapter. For this, see Pelle and Reber 2015.

Although numerous companies have joined in this innovation process for healthier food and take responsibility for societal problems, empirical research about RI in the private sector is scarce (Blok and Lemmens 2015; Blok et al. 2015). There is still little known about what drives companies to engage in the development of responsible innovations and whether these innovation processes can be characterised as responsible (cf. Stilgoe et al. 2013). In order to strengthen RI in the private sector, it is imperative to understand how companies organise this process, where it takes place (throughout the entire company or on specific levels), and what considerations and motivations are central in the innovation process.

In this chapter, the questions of whether and where normative considerations play a role in the innovation process, and whether dimensions of RI are present in the innovation process, are addressed. In order answer these research questions, a theoretical framework is developed based on Jones's theory of ethical decision making and Cooper's stage-gate model of innovation management (Jones 1991; Cooper 1990). The stage-gate model helps to elucidate how the innovation process is set up and where the key decision points are located, whereas Jones's theory can help to elucidate whether and where ethical considerations play a role in the decision-making process. Mapping the operational innovation process in this way makes it also possible to assess whether process dimensions of RI – anticipation, reflexivity, inclusion and responsiveness – are present in the innovation process (cf. Owen et al. 2013).

In order to answer the research questions, a specific case of innovations that contribute to public health is explored, namely, that of food companies that participate in a Front-of-Pack (FoP) logo for healthier food. FoP logos are used on food products to inform consumers about the healthier options in a product group. Food companies can only carry such logos when they meet a certain set of nutritional criteria, which are determined by the organisation behind the specific FoP logo (Jansen and Roodenburg 2015). When joining such a programme, or when existing criteria are tightened, companies are pushed to innovate for healthier food products in order to enable them to achieve or keep the logo.

As the use of healthy food logos does not necessarily have a positive impact on sales and profits (Jansen et al. 2015), it is expected that in the decision-making process, as part of their innovation process, companies make several trade-offs between economic, technical *and* moral factors (Jahromi and Manteghi 2012). As the social-ethical values at stake in corporate innovation processes have remained to a large extent unexplored in research on innovation management, the aim of this chapter is to identify the motivations and barriers for companies embracing and continuing a FoP logo for healthier food, and to assess whether ethical considerations play a role in this innovation process.

The remainder of this chapter is structured as follows: in Sect. 12.2, a theoretical framework is developed based on a literature review in the field of ethical decision making, RI and innovation management. In Sect. 12.3, the methodology is set out. The results are analysed in Sect. 12.4 and, in the final section, a conclusion is provided, as well directions for future research.

From the findings in this research, it will become clear that although the studied companies participated in a programme for healthy food and thus are responsive to the needs of society, and although the companies feel (partially) responsible for public health, ethical considerations do not play a central role in the operational innovation process. Instead, technical and economic considerations seem to prevail in the operational innovation process. Furthermore, none of the procedural dimensions of RI seems to be present at this level in the innovation trajectory. It is argued that this may be an indication that the ethical decision-making process for RI is not located at the level of the operational innovation process itself, but is something that might be located on a higher strategic level in the company. It is at this level that the moral decision is taken to adopt the FoP logo and to engage in the RI process. The findings cast a new light on the discourse on RI in general, and in the private sector in particular.

12.2 Literature Review

Because the exploration of the ethical decision-making process regarding RI for public health is the central goal of this chapter, the literature review starts with ethical decision making, followed by theories regarding RI and innovation management processes.

12.2.1 Ethical Decision Making

There is a wide variety of models of ethical decision making, but Jones's process-based four-stage model (1991) is considered to be one of the most inclusive and comprehensive (Crane and Matten 2010). According to Jones, ethical decision making takes place in four steps: (1) recognising moral issues; (2) making a moral judgement; (3) establishing moral intent and (4) engaging in moral behaviour (Jones 1991).

The process of ethical decision making starts with *the recognition of a moral issue*. A moral issue is present when a person freely engages in an action that could harm or benefit others. This means that many decisions have a moral dimension, but, in order to engage in ethical decision making, an actor has to recognise that he is dealing with a moral issue. An actor has to realise that his voluntary choice or action will affect other human beings. In the context of the development of food products, this can for instance refer to the awareness that certain ingredients can have a negative impact on consumer health. An ethical dilemma can arise when economic considerations of profit have to be weighed against societal interests (Nathan 2015). When a moral issue is not recognised, the decision-making process takes place according to other rationales, like for instance that of economic rationality (Jones 1991).